

Recognition Performance in the Case of Juvenile Fingerprints



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- Children yet to be excluded when it comes to verification against templates older than 1 or 2 years:
 - Children <12 currently not fingerprinted for neither EU passport nor Visa Information System
 - Parliament and EDPS not convinced about feasibility and accuracy performance
 - Identification and verification to be guaranteed over time, given the validity of an enrolment for about 5 years
- Biometric verification can be expected
 - to impede child trafficking
 - to reduce abuse of children for fraud
 - to help identifying missed children



- Matchers do not directly take into account the growing of the ridge pattern
- Resolution of scanners and assumptions about dimension of ridge structure is another obstacle
- Children fingerprinting exists only for documentation purposes but is hardly applicable to AFIS

→ Dedicated feasibility study more than overdue !



Source: Anthony's Mobile Fingerprinting

6 years

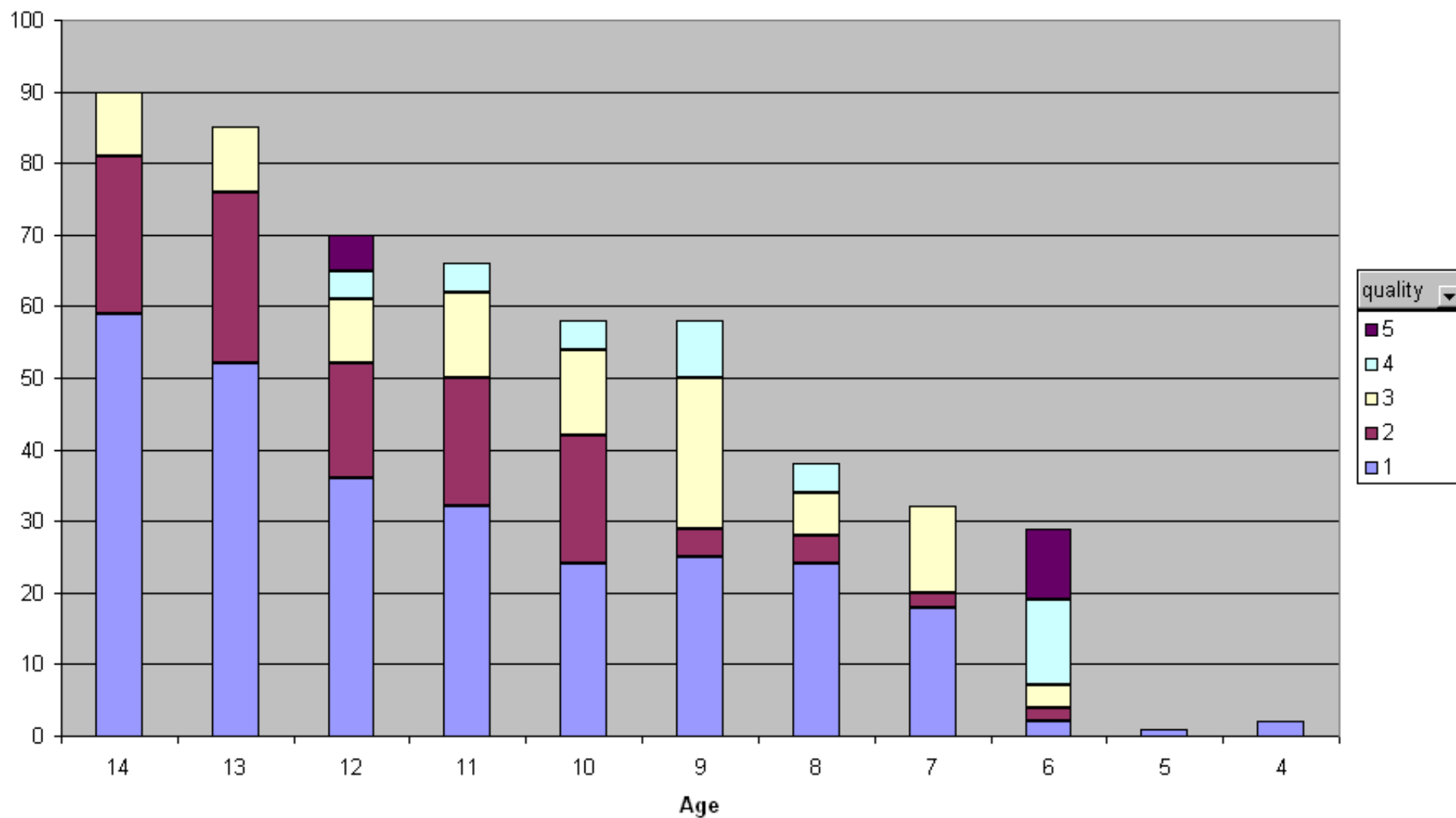


- Ridge distance of 6 years old only half of adults: from ~10 pixels down to ~5 pixels [@500dpi]
- Likelihood of low contrast regions increase

12 years



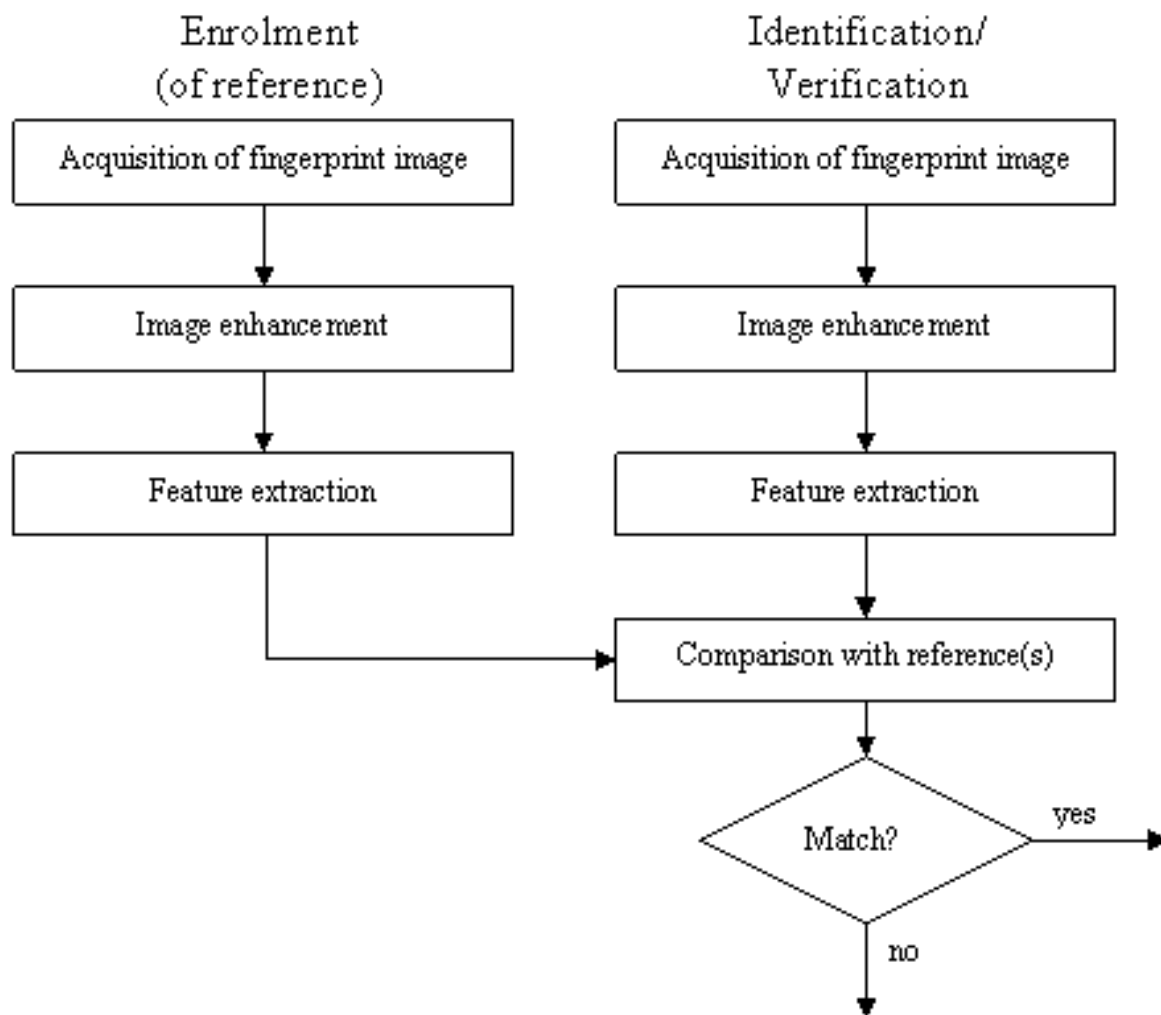
- Quality metrics (like NFIQ) not trained for juvenile fingerprints



*BIODEV = European study on operational aspects of visa application including biometric enrolment

Time = T_0

Time = T_1 , $T_1 \gg T_0$



Difficulties in getting “still” images

Contrast problems

Wrong assumption about ridge distance

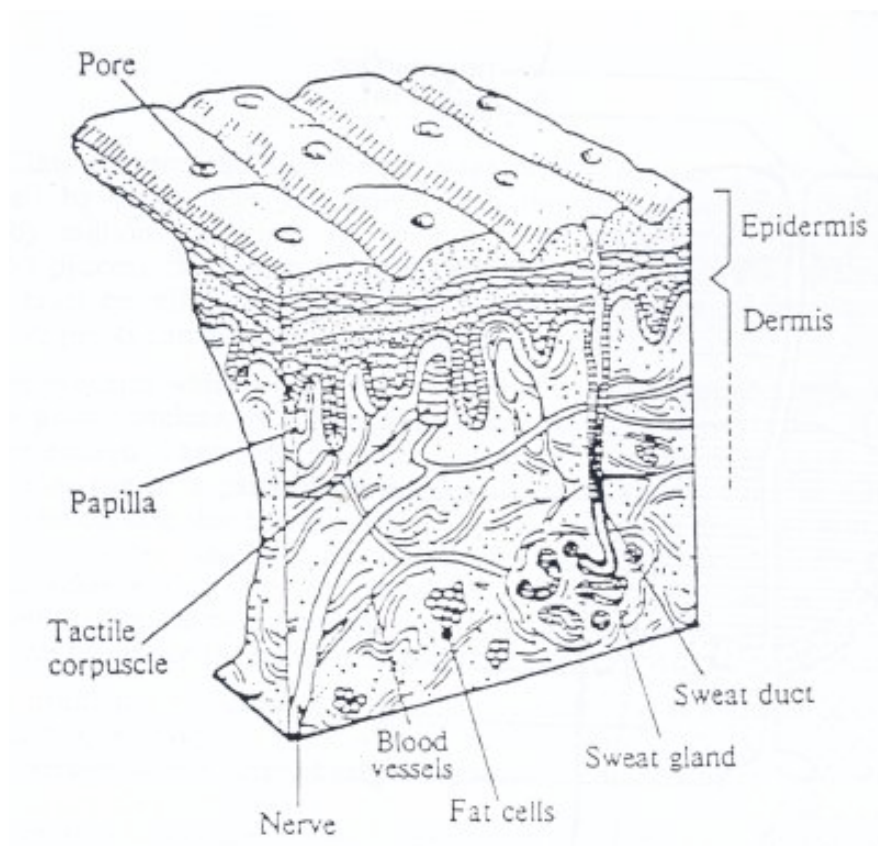
Local features displacement beyond accepted level of “distortion”

- Can be extremely difficult to enrol young children because of inadequate scanning device and overall setup
- Need for manual help by an operator is disputable
- Time to enrol can be acceptable for first enrolment but can be unacceptable for verification
- Enrolment should become more tolerant against movements
- Touchless sensors (“on the fly”) could become the ultimate choice



Image: Ultimate Woodlands

- Imprint distance between ridge lines can be down to 0.1 mm (= 2 pixel @ 500 dpi) for adults!
- Proper acquisition process can partially avoid this





Raw Image

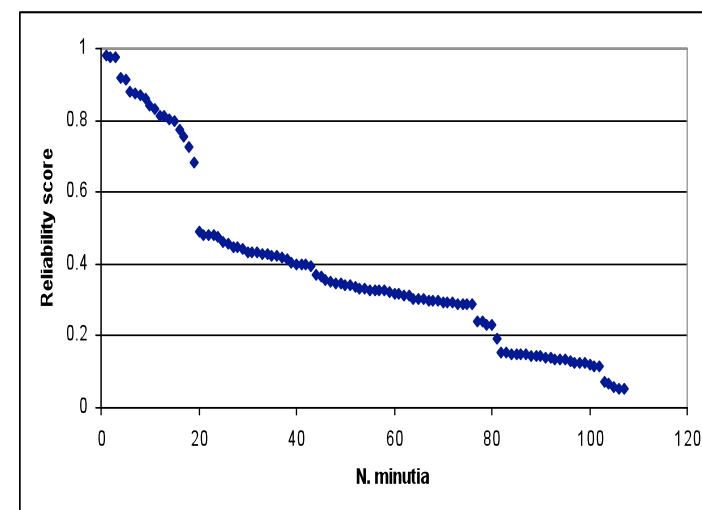


Pre-Processed

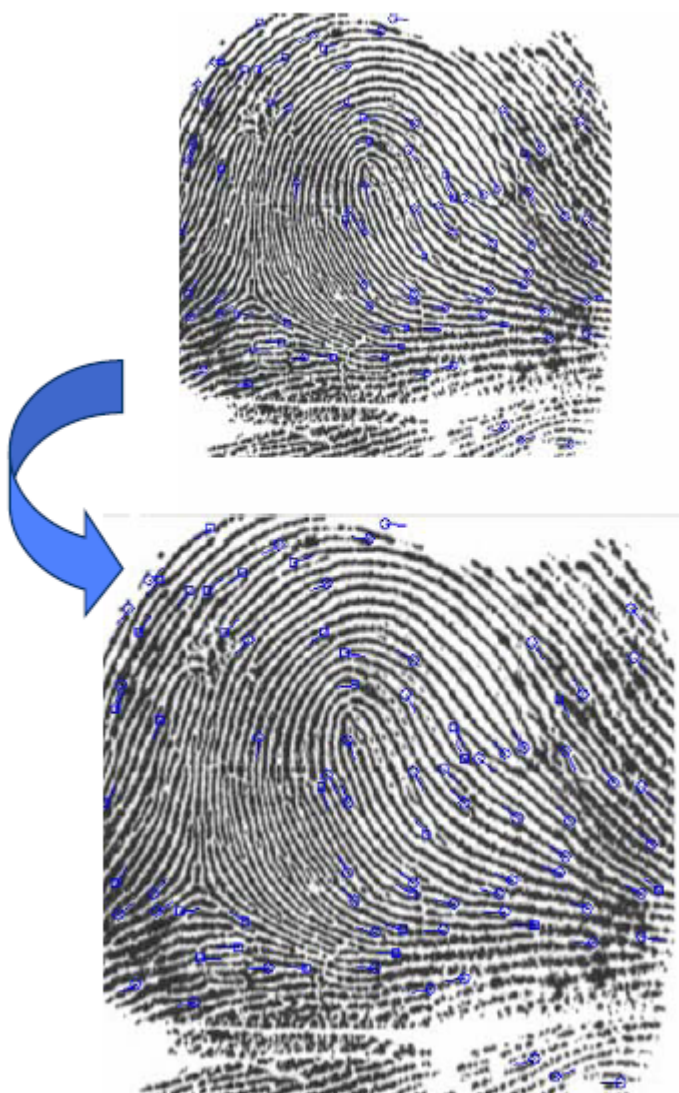
Example: Age = 6, NFIQ = 4

NIST *mindtct* finds

- ✓ 107 minutiae
- ✓ 15 minutiae have reliability score > 0.8



Matching



- Matching should establish a similarity score between a template and a (kind-of) “zoomed” image
- Not yet clear whether “zooming” is linear or subject to significant distortion
- Feature extraction is usually not the same for different zooming levels of an image
- Not only minutiae positions are considered

- 500 dpi images of very young children can be excellent
→ *Elaboration on relevant conditions necessary*
- Some vendors have already introduced ridge distance adoption and experimented with assumed ageing
→ *Feedback to vendors on measured growing effect*
- Yet no statistics available on recognition performance against aged templates in case of juveniles
→ *Need for a test database with significant time period between enrolments of individual juvenile test subjects*

- ✓ Find best practice how to acquire images of sufficient quality
- ✓ Approximate ridge distance growing curve and use this for enhanced feature extraction
- ✓ Use test database to measure local feature displacement and degree of deviation from pure affine transformation
- ✓ Cooperate with vendors for introducing “juvenile feature”
- ✓ Use test database to measure performance of enhanced matchers
- ✓ Derive overall feasibility conclusion

- Automated verification and identification of children fingerprints likely to be feasible in practice at acceptable performance level
- Feasibility question will be tackled in several tasks:
 - Physiological effects
 - Enrolment best practices
 - Algorithmic enhancements
 - Performance test on large data sets
- Preliminary results might become available by end of 2010

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